

**PATENT APPLICATION TRANSMITTAL LETTER**

TO THE COMMISSIONER OF PATENTS AND TRADEMARKS:

Transmitted herewith for filing is the patent application of: **ELLIOTT B. WEINGER** entitled **"MEDICAL X-RAY DIGITIZING AND CHART STORAGE SYSTEM"** including specification, abstract, and claims totalling **12** pages.

Enclosed are:

- ☒ 2 sheet(s) of ☒ formal, ☐ informal drawing(s).  
☒ Verified Statement claiming small entity status under 37 CFR 1.9 & 1.27.  
☒ Executed Declaration by the Inventors.  
☐ Preliminary Amendment  
☐ Associate Power of Attorney

☒ **CLAIMS AS FILED SMALL ENTITY**

Basic Filing Fee		\$395.00
Total Claims 17 - 20 = excess	x \$11.00 =	\$0
Indep Claims 4 - 3 = 1 exces	x \$41.00 =	\$41.00
Multiple Dependent Claims	x \$135.00 =	\$
=====		
TOTAL		\$436.00

☐ **CLAIMS AS FILED OTHER THAN A SMALL ENTITY**

Basic Filing Fee		\$790.00
Total Claims - 20 = excess	x \$22.00 =	\$
Indep Claims - 3 = excess	x \$82.00 =	\$
Multiple Dependent Claims	x \$270.00 =	\$
=====		
TOTAL		\$

- ☒ A duplicate copy of this sheet is enclosed.  
☒ Certificate of Express Mail.  
☒ A check in the amount of \$395.00 to cover the filing fee is enclosed.  
☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. 13-1130 as described below. I have enclosed a duplicate copy of this sheet.

☒ **Charge the amount of \$41.00 for the presence of one extra independent claim.**

- ☒ Credit any overpayment.  
☐ Charge any additional filing fees required under 37 CFR 1.16 and 1.17.  
☐ Charge the issue fee set in 37 CFR 1.18 at the mailing of the Notice of Allowance, pursuant to 37 CFR 1.311(b).

August 21, 1998  
DATE

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Attorney Docket No. 9789.3801

TITLE OF THE INVENTION  
MEDICAL X-RAY DIGITIZING AND CHART STORAGE SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS  
N/A

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT  
N/A

BACKGROUND OF THE INVENTION

1. Field of the Invention

5 This invention relates to electronic processing of X-ray  
roentgenograms, and more particularly to an electronic process  
that includes the transference of X-ray roentgenograms to a high  
resolution digital form that can incorporate patient information,  
including name and medical record number, and/or bar-coding, that  
can be printed for inclusion with the patient's office or hospital  
chart, that can be digitally enhanced to improve diagnoses, and/or  
10 that can be stored in a medical computer system for ready  
retrieval.

2. Description of Related Art

15 In the medical field, patient hospital or office charts  
presently include only typed or printed reports. X-rays films  
taken of the patient for diagnostic or other purposes are kept  
separate from the patient's medical chart. Even in the most  
efficient hospitals, X-ray films are often misplaced or even lost.  
In large patient volume emergency room operations, X-ray films may  
"disappear" and are occasionally never found.

20 Orthopedic Surgeons typically read their own X-ray films. It  
would be an invaluable aid to their practice to actually see an x-  
ray picture rather than a verbal or written interpretation that is

often delayed by as much as 24 to 36 hours before appearing on a hospital record.

In providing off hours emergency room (E.R.) coverage, Orthopedic surgeons and other specialists are typically at the mercy of in-experienced resident, or E.R. Physicians, and must often make a decision for emergency care based upon interpretations of x-rays which are frequently inaccurate.

The above problems are also encountered in many other areas of medicine including internal medicine, surgical specialties, and radiology.

#### BRIEF SUMMARY OF THE INVENTION

The present invention provides a system for transferring x-ray roentgenograms to a digital format for patient hospital or office records. A high resolution digitizer such as a digital scanner interfaced with computer technology is used to scan each x-ray as it is delivered from the x-ray processor, to encode the x-ray with selected information such as the patient's name and medical record number, and to immediately print a hard paper copy to be included with the patient record. The hard paper copy can be a high resolution plain paper print out. The system can simultaneously store a digital representation of the x-ray picture in a computer readable format for easy access, and/or transmission to another site, at any time. Thousands of x-ray prints can be stored indefinitely on discs, saving vast amounts of storage space.

The applications of the present invention include hospitals and most large physician offices and multi-specialty clinics throughout the United States, and potentially the world. The ability to view an x-ray picture directly as part of the hospital record by utilizing the present invention is a tremendous asset to patient care.

Utilizing the present invention for Orthopedic surgery, x-ray prints could be faxed or electronic mailed (e-mailed) via computer and modem to the physician's home or office to allow the specialist to make a far more accurate interpretation and correct  
5 decision for treatment.

In general and pulmonary medicine, chest x-rays and abdominal films would benefit from the present invention and could include the addition of "colorization techniques" to colorize a pulmonary infiltrate or lesion and monitor its progression with treatment.

10 Radiologists utilizing the present invention will be able to give virtually immediate preliminary x-ray reports on all x-rays which typically might not otherwise be read for many hours, possibly delaying critical patient care. Utilizing the present invention, the x-ray image can be faxed or e-mailed directly to  
15 the radiologist's home. The radiologist can write a preliminary interpretation and fax or e-mail the report back to the hospital or other source, dramatically enhancing the efficiency of health care to the patient.

Accordingly, it is an object of the present invention to  
20 provide a system for transferring x-ray roentgenograms to a high resolution print for inclusion with a patient hospital or office record.

It is another object of the present invention to provide a system for transferring x-ray roentgenograms to computer readable  
25 format for storage and/or transmission.

In accordance with these and other objects which will become apparent hereinafter, the instant invention will now be described with particular reference to the accompanying drawings.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

30 Figure 1 is a diagrammatic view of the present invention.

Figure 2 is a diagrammatic view of an alternate embodiment of the present invention.

#### DETAILED DESCRIPTION OF THE INVENTION

Referring to Fig. 1, a block diagrammatic view of one embodiment of the present invention is illustrated. X-ray processor 2, which can be a conventional x-ray machine, produces x-ray roentgenogram 4. Digitizer 6, which is discussed further hereinbelow, converts x-ray roentgenogram 4 into a computer readable digital format which is read by computer 8. Once the digitized image of x-ray 4 is read by computer 8, the digitized image can be combined with patient data entered via keyboard 10, or via mass storage device 12. The patient data entered can be the patient identification information including name and medical record number. The mass storage device 12 can be one or more conventional disc drives (hard drives, floppy drives, and/or compact discs (CDs)) or other magnetic or other non-volatile storage media as known in the art.

Once the patient data is combined with the digital image of the x-ray, which takes place very quickly, the x-ray and patient identification data can be printed by a high resolution printer 14, and/or displayed by a suitable high resolution monitor 16. The patient identification data will be formatted to be printed with the x-ray image in a preselected location so as not to interfere with interpretation of the x-ray image. A printed x-ray image can then be attached to, and remain with, the patient medical chart.

The x-ray image and patient data can be sent via facsimile 18 and/or e-mail 20 to remote sites. Transmitting the x-ray image in this manner, allows physicians in sites remote from the x-ray machine 2 and actual x-ray roentgenogram 4, to view a high quality x-ray image and improve the ability to make a quick and accurate diagnosis. The e-mail modem 20 further provides the ability to transmit the x-ray image over the Internet so that specialists located anywhere in the world with Internet access can receive a high quality x-ray image. Of course, the quality of the x-ray

image displayed and/or printed will be partially dependent upon the quality of the hardware at the remote site.

In addition to the x-ray image and patient identification information, the entire patient medical record can be retrieved from storage device 12, and transmitted along with the x-ray image. The physicians located at remote sites can interpret the x-ray image along with the patient medical record, and prepare preliminary reports. The preliminary reports can be faxed 18 or e-mailed 20, back to the site of origin of the x-ray 4. The e-mail modem connection 20 provides the capability of sending preliminary reports over the Internet.

The x-ray image, with affixed patient data, along with the full patient record stored within storage device 12, can be quickly retrieved and printed 14, displayed 16, and/or transmitted by facsimile 18 or e-mail 20 at any time. In addition, the patient medical chart will have a high resolution printed x-ray image that will remain with the chart at all times. The actual x-ray roentgenogram 4 can be stored, but it will no longer be necessary to locate the actual x-ray 4 roentgenogram to view the x-ray image.

X-ray image quality is a function of spatial resolution and definition. Spatial resolution is an objective measure of the ability of a system to resolve high-contrast line pairs on the final x-ray image. Definition is a subjective evaluation of an image based on its overall general appearance which may include factors such as edge sharpness, contrast range, brightness, clarity, and other screen qualities that influence the way an image appears.

Resolution of film and digital images are measured in different ways, and definition is often more important than spatial resolution for interpretation of x-ray images. However, the x-ray film and the digital image produced therefrom must resolve fine detail to be useful in many medical applications.

With x-ray film, spacial resolution can be measured by the number of high contrast line pairs per millimeter that can be seen on the film. Film x-ray images are capable of resolving 10 line pairs per millimeter of high contrast metal wires, which is high  
5 spacial resolution.

Digital resolution can be measured by the number of samples per millimeter. With resolutions the range of .50 to 10 samples per millimeter being desirable. Although film x-rays typically have higher spatial resolution in absolute terms, digital images  
10 can provide benefits because of the ability to manipulate the digital data. Digital enhancement of particular regions of a displayed image are possible, as well as the ability to shift contrast ranges.

To digitize 6 the x-ray roentgenogram 4, a high resolution  
15 digital scanner can be utilized. The output of the scanner is a digital computer readable format of the x-ray image. There are presently x-ray quality digital scanners available, such as those available through Cannon or Adara Technology, for example. These systems typically have an 8 bit to 12 bit dynamic range.

In an alternate embodiment, a digital camera can be utilized  
20 to convert the x-ray image 4 to a digital representation of the image. Essentially, a conventional digital camera takes a still picture of the x-ray, but does not require development of film. The output of the digital camera, instead of a photograph of the  
25 x-ray image, is a computer readable, digital representation of the x-ray image.

An example of yet another digitization technique is disclosed in U.S. Patent No. 4,723,260 to Haneda et al. (Haneda), the entire disclosure of which is incorporated herein by reference. The  
30 Haneda teaches use of a TV camera and A/D converter for digitization of x-ray images, and the storage in digital form of a single frame.

Referring to Fig. 2, still another embodiment of the present invention is illustrated. The x-ray processor 2 and digitizer 6 are combined into a single x-ray machine 60 that has as an output, a digital image of the x-ray 4.

- 5       The instant invention has been shown and described herein in what is considered to be the most practical and preferred embodiment. It is recognized, however, that departures may be made therefrom within the scope of the invention and that obvious modifications will occur to a person skilled in the art.

35T380-T6H2E60



CLAIMS

What Is Claimed Is:

1. A method for conversion of an x-ray roentgenogram to a digital computer readable image that is combined with preselected patient information and printed, comprising:
  - providing an x-ray roentgenogram;
  - digitizing said x-ray roentgenogram to form a high resolution digital x-ray image thereof;
  - combining said digital x-ray image with a preselected patient identification data and formatting said combination for printing so that said preselected patient identification data will not obscure said digital x-ray image when printed;
  - printing a high resolution image of said combination of said digital x-ray image and said preselected patient identification data.
2. The method of claim 1, further including:
  - displaying said combination of said digital x-ray image and said preselected patient identification data on a monitor.
3. The method of claim 1, further including:
  - storing said combination of said digital x-ray image and said preselected patient identification data in a non-volatile storage medium.
4. The method of claim 1, further including:
  - transmitting said combination of said digital x-ray image and said preselected patient identification data by facsimile.
5. The method of claim 1, further including:

transmitting said combination of said digital x-ray image and said preselected patient identification data by modem.

6. A method for conversion of an x-ray roentgenogram to a digital computer readable image that is combined with preselected patient information and printed, comprising:

providing an x-ray roentgenogram;

digitizing said x-ray roentgenogram to form a high resolution digital x-ray image thereof;

combining said digital x-ray image with a preselected patient identification data and formatting said combination for printing so that said preselected patient identification data will not obscure said digital x-ray image when printed;

transmitting said combination of said digital x-ray image and said preselected patient identification data.

7. The method of claim 6, further including:

displaying said combination of said digital x-ray image and said preselected patient identification data on a monitor.

8. The method of claim 6, further including:

storing said combination of said digital x-ray image and said preselected patient identification data in a non-volatile storage medium.

9. The method of claim 6, further including:

printing a high resolution image of said combination of said digital x-ray image and said preselected patient identification data.

10. A system for conversion of an x-ray roentgenogram to a digital computer readable image that is combined with preselected patient information and printed, comprising:

means for providing an x-ray roentgenogram;

means for digitizing said x-ray roentgenogram to form a high resolution digital x-ray image thereof;

5 means for combining said digital x-ray image with a preselected patient identification data and formatting said combination for printing so that said preselected patient identification data will not obscure said digital x-ray image when printed;

10 means for printing a high resolution image of said combination of said digital x-ray image and said preselected patient identification data.

11. The system of claim 10, further including:

15 means for displaying said combination of said digital x-ray image and said preselected patient identification data on a monitor.

12. The system of claim 10, further including:

means for storing said combination of said digital x-ray image and said preselected patient identification data in a non-volatile storage medium.

20 13. The system of claim 10, further including:

means for transmitting said combination of said digital x-ray image and said preselected patient identification data

25 14. A system for conversion of an x-ray roentgenogram to a digital computer readable image that is combined with preselected patient information and printed, comprising:

means for providing an x-ray roentgenogram;

means for digitizing said x-ray roentgenogram to form a high resolution digital x-ray image thereof;

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means for combining said digital x-ray image with a  
preselected patient identification data and formatting said  
combination for printing so that said preselected patient  
identification data will not obscure said digital x-ray image when  
5 printed;

means for transmitting said combination of said digital  
x-ray image and said preselected patient identification data.

15. The system of claim 14, further including:

means for displaying said combination of said digital x-  
10 ray image and said preselected patient identification data on a  
monitor.

16. The system of claim 14, further including:

means for storing said combination of said digital x-ray  
image and said preselected patient identification data in a non-  
15 volatile storage medium.

17. The system of claim 14, further including:

means for printing a high resolution image of said  
combination of said digital x-ray image and said preselected  
patient identification data.

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ABSTRACT OF THE DISCLOSURE

A system and method for transferring x-ray roentgenograms to a digital format for patient hospital or office records is provided. A high resolution digitizer interfaced with computer  
5 technology is used to scan each x-ray as it is delivered from the x-ray processor, to encode the x-ray with selected information such as the patient's name and medical record number, and to immediately print a hard paper copy to be included with the patient record. The hard paper copy can be a high resolution  
10 plain paper print out. The system can simultaneously store a digital representation of the x-ray picture in a computer readable format for easy access, and/or transmission to another site, at any time. Thousands of x-ray prints can be stored indefinitely on discs, saving vast amounts of storage space.

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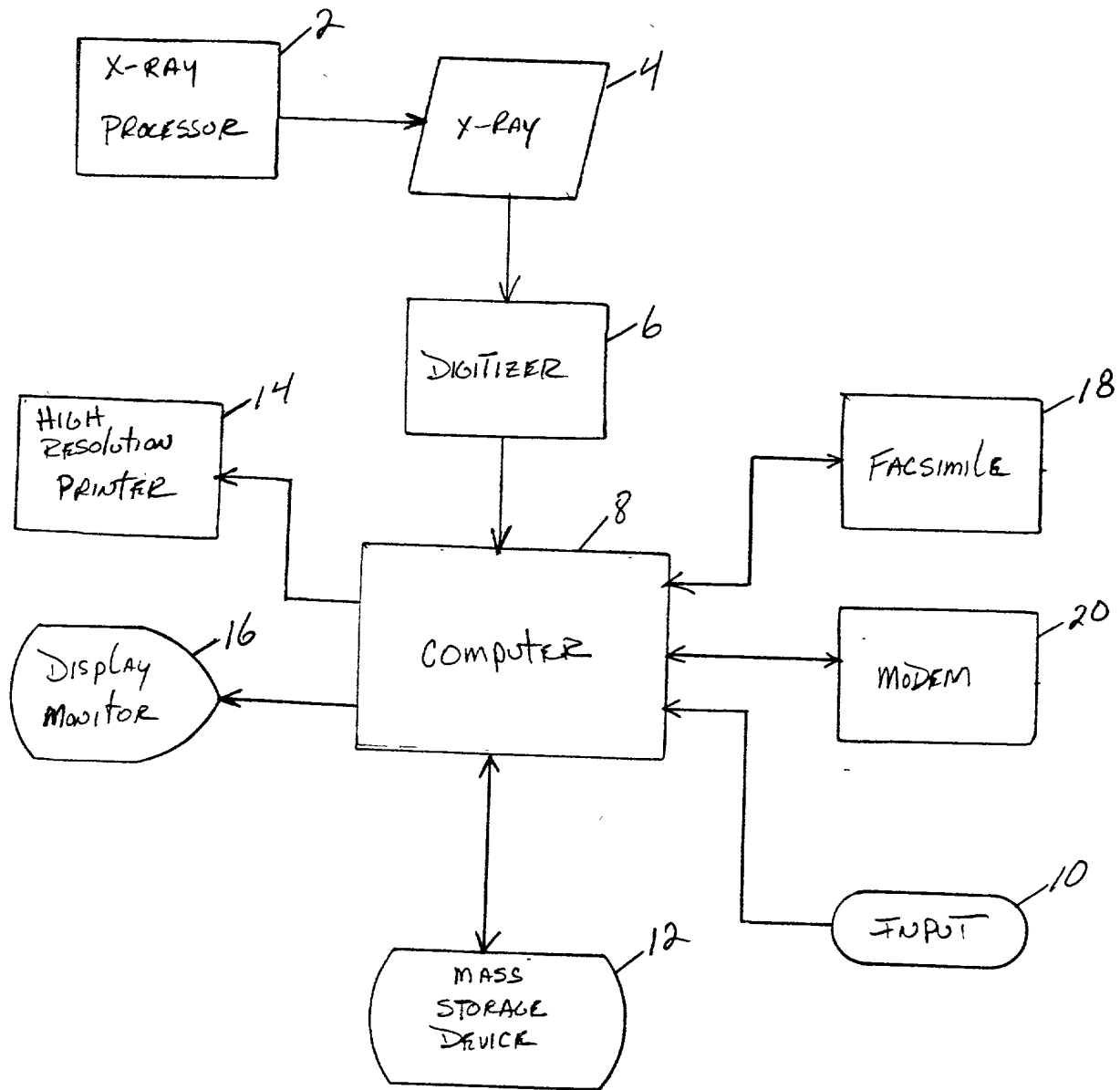


FIG 1

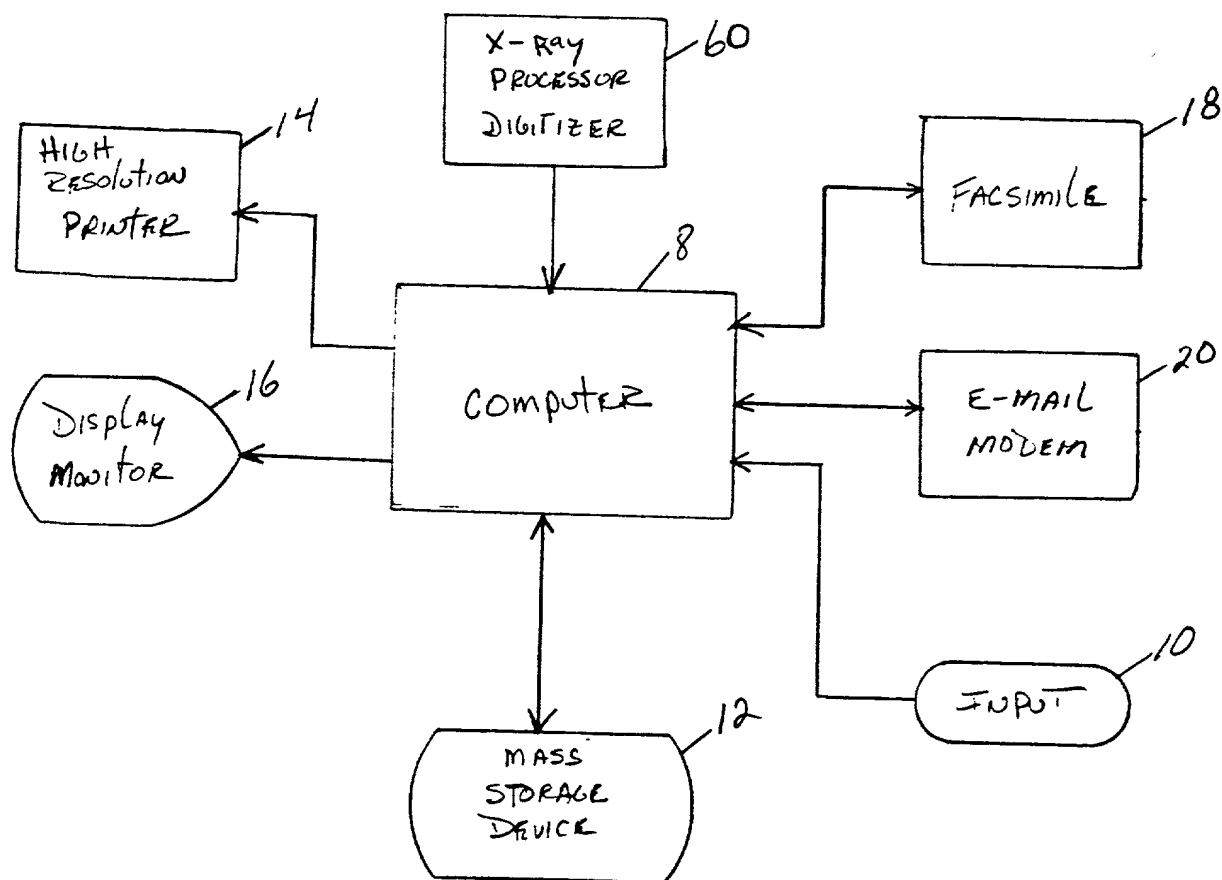


FIG 2

**DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION**  
**(English Language Declaration)**

File No. 9789.3801

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **MEDICAL X-RAY DIGITIZING AND CHART STORAGE SYSTEM**, the specification of which (check one):

☒ is attached hereto

☐ was filed on    as Serial No.    and was amended on    (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the Office all information known to me to be material to patentability, as defined in Title 37, Code of Federal Regulations §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

<u>Prior Foreign Application(s)</u>		<u>Day/Month/Year</u>	<u>Priority Claimed</u>	
<u>Number</u>	<u>Country</u>		<u>Yes</u>	<u>No</u>
			[ ]	[ ]
			[ ]	[ ]
			[ ]	[ ]

I hereby claim the benefit under Title 35, United States Code 120, of any United States application(s) or PCT international application(s) designating the United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code 112, I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations 1.56, which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

<u>Serial No.</u>	<u>Filing Date</u>	<u>Status</u>
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.



## POWER OF ATTORNEY

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith along with any and all foreign applications filed and foreign patents issued therefrom.

Barry L. Haley, Registration No. 25,339  
Dale Paul DiMaggio, Registration No. 31,823  
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Full Name of Sole or First Inventor

**U.S.A.**

Citizenship

Inventor's Signature

Date

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Citizenship

Second Inventor's Signature

Date

Residence

Post Office Address

Full Name of Third Joint Inventor, if any

Citizenship

Third Inventor's Signature

Date

Residence

Post Office Address

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Applicant or Patentee: Dr. Elliott B. Weinger

Serial No. or Patent No.: To Be Assigned

Filed or Issued: Herewith

For: MEDICAL X-RAY DIGITIZING AND CHART STORAGE SYSTEM

Attorney's

Docket: 9789.3801

**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS**  
**(37 CFR 1.9(c) and 1.27(b)) - INDEPENDENT INVENTOR**

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under §41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled MEDICAL X-RAY DIGITIZING NAD CHART STORAGE SYSTEM described in

☒ the specification filed herewith

☐ application serial no. , filed

☐ patent no. , issued

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

☒ no such person, concern, or organization

☐ persons, concerns, or organizations listed below\*

NOTE: Separate Verified Statements are required from each named person, concern, or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

FULL NAME:

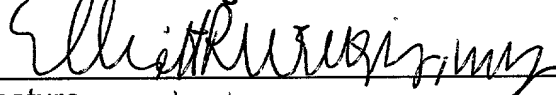
ADDRESS:

☐ INDIVIDUAL      ☐ SMALL BUSINESS CONCERN      ☐ NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Dr. Elliott B. Weinger



Signature

Date: 8/17/98